MUFFLER FOR MOTOR VEHICLE

TECHNICAL FIELD

The present invention relates to a muffler for a motor vehicle employing for an engine exhaust in a motor vehicle, especially having a constitution such that flowing resistance of the exhaust gas can be changed in accordance with traveling condition of the vehicle.

BACKGOURND OF THE INVENTION

As a prior art regarding a muffler (a silencer), JP 9-166010 A discloses a silencer device comprising a casing, a gas intake tube to the casing, tubes installed in the casing, diaphragms, supporting elastic members, a piston bar, a pressure container as a control mechanism providing with pressure connection portions, a valve closing element attached on the piston bar, and a pressure introducing tube transmitting a whole gas pressure to a pressurized side of the diaphragms, wherein the pressure container has a plurality of chambers defined by the diaphragms, each of the diaphragms is supported by the elastic members, each of the chambers has the pressure connection portion, and another pressure introducing tube transmits the static pressure of the gas to a low pressure side of the diaphragms. Thus, in the muffler disclosed in the reference invention, variable attenuation characteristics can be gained without an outer control device.

In the prior silencer device, a plurality of tubes which are communicated between the outside and inside thereof and transmit the gas between three expansion chambers are arranged in parallel and

perpendicularly, so that there is a disadvantage such that a size of the whole device must be enlarged.

DISCLOSURE OF THE INVENTION

Therefore, an object of the invention is to provide a muffler for a motor vehicle which can achieve appropriate gas-exhausting characteristics in accordance with traveling condition of the vehicle while downsizing during maintaining the performance.

A muffler for a motor vehicle according to the present invention, which is provided on an exhaust gas passage of an internal engine installed on the motor vehicle, comprises a casing main body which is an outermost shell; an exhaust gas introducing pipe which constitutes an end of the exhaust gas passage and includes an extending portion extending into the casing main body, and further having a plurality of small holes in the extending portion thereof; a finisher which is located on a line extending from the exhaust gas introducing pipe and consists of an inner portion located in the casing main body and an outer portion extending from the casing main body; a silencer mechanism consisting of expansion chambers defined by the extending portion of the exhaust gas introducing pipe and pipe members arranged at specific intervals in a radial direction outside the inner portion of the finisher and a constriction mechanism; and a valve mechanism which is located on an end of the exhaust gas introducing pipe and which makes communication between the exhaust gas introducing pipe and the finisher open when exhaust gas pressure in the exhaust gas introducing pipe has exceeded a specific value.

Besides, in the present invention, it is preferred that the pipe members are a first inner pipe located at a specific interval inside the casing main body and a second inner pipe located at a specific interval inside the first inner pipe into which the exhaust gas introducing pipe and the finisher are inserted in opposite directions; the expansion chambers are constituted of a first expansion chamber defined between the exhaust gas introducing pipe and the casing main body, a second expansion chamber defined between the finisher and the casing main body and a third expansion chamber defined between the exhaust gas introducing pipe and the finisher inside the second inner pipe; the constriction mechanism is constituted of a first passage communicating between the first expansion chamber and the second expansion chamber and a second passage communicating between the second expansion chamber and the third expansion chamber; and the valve mechanism communicates between the exhaust gas introducing pipe and the finisher via the third expansion chamber when it has opened.

Furthermore, the second passage is preferably a space formed between the second inner pipe and the finisher. The first passage is preferably constituted of a first space defined between the first inner pipe and the casing main body and a second space defined by the first inner pipe and the second inner pipe. It is preferred that an acoustic material is arranged in an exhaust gas introducing pipe side of the second space.

Besides, it is preferred that the first passage is a space defined between the first inner pipe and the second inner pipe, and an acoustic material is arranged in a space defined between the first inner pipe and

the casing main body.

Furthermore, it is preferred that the first passage is a space defined between the first inner pipe and the casing main body, and an acoustic material is arranged in a space defined between the first inner pipe and the second inner pipe.

It is preferred that the valve mechanism is provided with a valve body moving so as to open and close the exhaust gas introducing pipe and an elastic member urging the valve body to a close direction at a specific pressure, and further a means for adjusting pressure which can adjust pressure by the elastic member through the finisher from an outside.

Furthermore, it is preferred that the valve body is in an approximately conical shape such as to spread gradually to a downstream side in a flow direction of exhaust gas and its top is in a smooth round shape.

In the present invention, the pipe members are a first inner pipe which is arranged approximately concentrically relative to the exhaust gas introducing pipe and which is in a cylindrical shape with an opening in one side thereof having a downstream side closing bottom surface portion secured around the exhaust gas introducing pipe in a downstream side of an exhaust direction of the small holes; a second inner pipe which is arranged approximately concentrically relative to the exhaust gas introducing pipe, which is in a cylindrical shape with an opening in one side thereof, which has a upstream side closing bottom surface portion secured around the exhaust gas introducing pipe in a upstream side of the exhaust direction of the small holes and which has a radius larger by a

specific value than one of the first inner pipe; a third inner pipe which is overlapped at a specific area to the first inner pipe, whose downstream end portion is connected to the finisher, which is in a cylindrical shape with openings in both ends thereof, and which has a radius smaller by a specific value than one of the first inner pipe, and a fourth inner pipe which is arranged inside the third inner pipe and which includes an upstream side expanding radius portion whose end is secured on an inner surface of the first inner pipe, a downstream side expanding radius portion whose end is secure on an inner surface of the finisher and downstream exhaust holes formed on the downstream side expanding radius portion. It is preferred that the silencer mechanism is constituted of a first exhaust passage which is defined by the first inner pipe and the second inner pipe and communicate to the small holes, a first expansion space which defined by the second inner pipe and the casing main body and on which the first exhaust passage is opened, a second exhaust passage which is defined the first inner pipe and the third inner pipe and which is communicated to the first expansion space, a third exhaust passage which is defined by the third inner pipe and the fourth inner pipe and which is communicated between the second exhaust passage and the downstream side exhaust holes, and a second expansion space which is defined inside the fourth inner pipe, on which the downstream side exhaust holes are opened and which is communicated to an opening of the finisher.

Furthermore, it is preferred that the exhaust gas introducing pipe is communicated to the opening of the finisher via the second expansion space when the valve mechanism has been opened.

Moreover, it is preferred that a fifth inner pipe is provided outside of the second inner pipe, has a closing bottom portion which closes communication between the second exhaust passage and the first expansion space and connects between the first exhaust passage and the second exhaust passage, and defines a fourth exhaust passage which is communicated between the first exhaust passage and the first expansion space in cooperation with the second inner pipe.

Besides, it is preferred that the valve mechanism is provided with a valve body which makes an end of the exhaust gas introducing pipe open and close and which is in a convex shape projecting to the upstream side of the exhaust direction, a spring pressing the valve body to an end of the exhaust gas introducing pipe, and a mechanism for adjusting spring pressure. The mechanism for adjusting spring pressure is preferably constituted of a holder portion for holding an end of the spring and a rotation portion for moving the holding portion relative to the valve body to adjust the spring pressure, and further the rotation portion is preferably located on a center line of the finisher and can be adjusted from an opening of the finisher.

Furthermore, the downstream side exhaust holes are preferably formed at regular intervals around the downstream side expanding radius portion of the fourth inner pipe, they are square shaped holes that upstream sides thereof are opened in a third exhaust passage side or are streamline shaped holes that upstream sides thereof are opened in the third exhaust passage side.

Moreover, a small expansion space is preferably formed between the downstream side closing bottom surface portion of the first inner

pipe and the upstream side closing bottom surface portion of the second inner pipe in an upstream side of the first exhaust passage.

Besides, the pipe members are preferably constituted of a first inner pipe which is arranged at a specific interval from an inner surface of the casing main body, a second inner pipe which is arranged at a specific interval from an inner surface of the first inner pipe, and a third inner pipe, wherein a valve mechanism is provided on a finisher side end of the third inner pipe, and a silencer mechanism is constituted of spaces defined by the casing main body, the first inner pipe, the second inner pipe and the third inner pipe.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a cross section view illustrating a structure of the muffler for the motor vehicle and a usual traveling condition according to a first working mode of the present invention;

FIG. 1B is a cross section view illustrating a structure of the muffler for the motor vehicle and a high speed traveling condition according to the first working mode of the present invention;

FIG. 1C is a cross section view cutting the cross section view in FIG. 1A at A – A line;

FIG. 2A is a cross section view illustrating a structure of the muffler for the motor vehicle and a usual traveling condition according to a second working mode of the present invention;

FIG. 2B is a cross section view illustrating a structure of the muffler for the motor vehicle and a high speed traveling condition according to the second working mode of the present invention;

FIG. 3A is a cross section view illustrating a structure of the muffler for the motor vehicle and a usual traveling condition according to a third working mode of the present invention;

FIG. 3B is a cross section view illustrating a structure of the muffler for the motor vehicle and a high speed traveling condition according to the third working mode of the present invention;

FIG. 4 is a cross section view of the muffler for the motor vehicle according to a fourth working mode of the present invention;

FIG. 5A is a front view of the downstream side expanding radius portion of the fourth inner pipe provided inside of the finisher;

FIG. 5B is a cross section view of the downstream side expanding radius portion of the fourth inner pipe provided inside of the finisher;

FIG. 6 is a cross section view of the muffler for the vehicle according to a fifth working mode of the present invention;

FIG. 7A is a front view of the downstream side expanding radius portion of the fourth inner pipe according to a sixth working mode;

FIG. 7A is a cross section view of the downstream side expanding radius portion of the fourth inner pipe according to a sixth working mode;

FIG. 8 is a cross section view illustrating a structure of the muffler for the motor vehicle and a usual traveling condition according to a seventh working mode of the present invention; and

FIG. 9 is a cross section view illustrating a structure of the muffler for the motor vehicle and a high speed traveling condition according to the seventh working mode of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Hereinafter, working modes of the present invention are explained by referring the attached drawings.

A muffler for a motor vehicle 1 according to a first working mode as shown in FIG. 1A, FIG. 1B and FIG. 1C is constituted of an exhaust gas introducing pipe 2, a casing main body 3, a finisher 4, a silencer mechanism 8 and a valve mechanism 6.

The exhaust gas introducing pipe 2 is to introduce exhaust gas discharged from an engine to the casing main body 3, is secured to a front side end of the casing main body 3 via a front side cover 10 and has a plurality of small holes 12. The casing main body 3 is a cylindrical member, and a first inner pipe 15, a second inner pipe 16 and an acoustic material 5 such as a glass-wool are arranged inside thereof to constitute a silencer mechanism 8 in which pulsation of the exhaust gas introduced through the exhaust gas introducing pipe 2 can be decreased.

The finisher 4 is a pipe-like member for discharging the exhaust gas passing through the casing main body 3 and is secured on a rear side end of the casing main body 3 via a rear side cover 11.

The first inner pipe 15 is a cylindrical member, wherein a front end thereof is secured to a front side fixture 19 which is fixed on the exhaust gas introducing pipe 2 and a rear end thereof is secured on a flange portion 13 of the rear side cover 11. The second inner pipe 16 is a cylindrical member with smaller radius than one of the first inner pipe 15 and arranged inside the first inner pipe 15, wherein a front end thereof is secured on the front side fixture 19 and a rear end thereof is secured on a rear side fixture 20 which is fixed on the finisher 4. The acoustic material

5 is filled up in an approximately half front part of a space between the first inner pipe 15 and the second inner pipe 16. Furthermore, a rear end of the exhaust gas introducing pipe 2 and a front end of the finisher 4 are positioned inside the second inner pipe 16.

The valve mechanism 6 is to change a route that the exhaust gas passes through the casing main body 3 in accordance with pressure of the exhaust gas from the engine. The valve mechanism 6 is provided on a rear end of the exhaust gas introducing pipe 2 and constituted of a fixing member 30, a rod member 31, a valve body 32, a valve sheet 33, a spring 34, a spring shoe 35, and a means for adjusting pressure 36.

The fixing member 30 is secured on an inner surface of the exhaust gas introducing pipe 2, has a constitution that the exhaust gas can pass through and is connected with a front end of the rod member 31. The spring shoe 35 is secured in the neighborhood of a rear end of the rod member 31. The valve body 32 is secured slidably in approximately middle portion of the rod member 31 and is a approximately conical member with a top portion 37 formed flatly. The valve sheet 33 is formed on a rear end of the exhaust gas introducing pipe 2 so as to be in contact with a slant surface of the valve body 32 airtightly. A front end of the spring 34 is secured on a rear side surface of the top 37 of the valve body 32 and a rear end thereof is secured on the spring shoe 35.

According to the muffler 1 with the above mentioned constitution, when pressure by the exhaust gas from the engine is smaller than pressure by the spring 34 (and atmospheric pressure), that is a usual traveling, as shown in FIG. 1A, the valve body 32 is in a closed condition, so that the exhaust gas passes, as shown by an arrow in FIG. 1A, through

a first expansion chamber 40 and then a first passage 41 defined between the casing main body 3 and the inner pipe 15, passing through the small holes 22 formed in the first inner pipe 15 to a second passage 42 defined between the first inner pipe 15 and the second inner pipe 16, then passing through a second expansion space 43 to a third passage 44 defined between the inner pipe 16 and the finisher 44, and then going into a third expansion space 45 inside the second inner pipe 16. In a usual traveling exhaust gas route as mentioned above, because the exhaust gas passes through three expansion spaces 40, 43 and 45, a sufficient sound deadening effect can be gained.

On the other hand, when the pressure by the exhaust gas from the engine is larger than the pressure by the spring 34 (and atmospheric pressure), that is a high speed traveling, as shown in FIG. 1B, the valve body 32 moves in an open condition, so that the exhaust gas goes, as shown by an arrow in FIG. 1B, into the third expansion space 45 directly. In a high speed exhaust gas route, the flowing resistance of the exhaust gas is decreased, so that an output of the engine can be increased.

As the above, according to the first working mode, at the usual traveling that the output of the engine is within a usual range or that an only low power is necessary, the valve body 32 in the valve mechanism 6 is in a closing position to pass the exhaust gas through the first, the second and third expansion space 40, 43 and 45, so that the sufficient sound deadening effect can be gained. On the other hand, at the high speed traveling or high power traveling such as acceleration, the valve body 32 moves to an opening position to introduce the exhaust gas to the third expansion space 45 directly, the output of the engine can be

increased because the flowing resistance of the exhaust gas can be decreased. Thus, muffler characteristics according to a traveling condition can be gained. Besides, the muffler 1 can be miniaturized rather than a constitution that the pipes are arranged in parallel with one another as a prior art by arranging the first inner pipe 15 and the second inner pipe 16 successively inside the casing main body 3 and further forming flow passages of the exhaust gas in spaces defined between them.

Hereinafter, other working modes are explained by referring to the drawings, but parts in the other working modes which are same as or similar to ones in the first working mode are remarked by same symbols in the first working mode in order to omit explanation thereof.

A muffler for a motor vehicle 50 according to a second working mode as shown in FIGS. 2A and 2B is that the second passage 42 between the first inner pipe 15 and the second inner pipe 16 is employed as a passage communicating between the first expansion space 40 and the second expansion space 43, an acoustic material 5 is arranged over a whole surface of the first passage 41 between the casing main body 3 and the first inner pipe 15.

An exhaust gas flow route in the second working mode is constituted of the first expansion space 40, the second passage 42 between the first inner pipe 15 and the second inner pipe 16, the second expansion space 43, the third passage 44 between the second inner pipe 16 and the finisher 4, and the third expansion space 45 in turn as shown in FIG. 2A. According to thus constitution, an area where the exhaust gas is in contact with the acoustic material 5 becomes large, so that the sound

deadening effect can be further increased. Besides, at a high speed traveling, as shown in FIG. 2B, the exhaust gas goes into the third expansion space 45 directly from the exhaust gas introducing pipe 2, so that the same effect as the first working mode can also be gained.

A muffler for a motor vehicle 60 according to a third working mode as shown in FIGS. 3A and 3B is that the first passage 41 between the casing main body 3 and the first inner pipe 15 is employed as a passage communicating between the first expansion space 40 and the second expansion space 43, the acoustic material 5 is arranged over an approximately whole surface in the second passage 42 between the first inner pipe 15 and the second inner pipe 16. Besides, a top portion 61 of the valve body 32 is in a smooth round shape and a surface backward of the top portion 61 is provided with a fixing member 62 for fixing an end of the spring 34.

An flowing route of the exhaust gas according to the third working mode is constituted of the first expansion space 40, the first passage 41 between the casing main body 3 and the first inner pipe 15, the second expansion space 43, the third passage 44 between the second inner pipe 16 and the finisher 4, and the third expansion space 45 in turn at the usual traveling as shown in FIG. 3A. According to thus constitution, the area where the exhaust gas is in contact with the acoustic material 5 can be enlarged similarly to the second working mode, so that the sound deadening effect can be increased. Besides, the exhaust gas goes from the exhaust gas introducing pipe 2 to the third expansion space 45 directly at the high speed traveling as shown in FIG. 3B, so that the same effect as the first and the second working modes can

be gained. Furthermore, the flowing resistance of the exhaust gas can be decreased by the shape of the top portion 61 of the valve body 32, so that the flowing resistance of the exhaust gas can be smaller than ones of the first and the second working modes.

A muffler for a motor vehicle 70 according to a fourth working mode as shown in FIG. 4 is constituted of at least the exhaust gas introducing pipe 2 which is connected to the exhaust side opening of the engine not shown in figures directly or indirectly, the finisher 4 which is located in a downstream side of an exhausting direction on an extending line of the exhaust gas introducing pipe 2, the silencer mechanism 8 provided between the exhaust gas introducing pipe 2 and the finisher 4, and a valve mechanism 6 which is provided in a downstream end in the exhaust direction A of the exhaust gas introducing pipe 2 and communicates between the exhaust gas introducing pipe 2 and the finisher 4 when pressure of the exhaust gas exceeds a specific value.

The muffler 70 further comprises a plurality of small holes 12 formed around an end of the exhaust gas introducing pipe 2 and neighborhood to the valve mechanism 6; the first inner pipe 15 that is arranged concentrically to the exhaust gas introducing pipe 2 and that is in a cylindrical shape with an opening in one end thereof having a downstream side closing bottom surface portion 71 which is secured around the exhaust gas introducing pipe 2 and in a downstream side of the small holes 12 in the exhaust direction A; the second inner pipe 16 that is arranged concentrically to the exhaust gas introducing pipe 2 and that is in a cylindrical shape with an opening in one end thereof and with a larger radius by a specific value than one of the first inner pipe 15

having an upstream side closing bottom surface portion 72 which is secured around the exhaust gas introducing pipe 2 and in an upstream side of the small holes 12 in the exhaust direction A; a third inner pipe 18 which is overlapped at a specific area with the first inner pipe 15, whose downstream side end portion 73 is connected to the finisher 4, which is in a cylindrical shape with openings in both ends thereof having a smaller radius by a specific value than one of the inner pipe 15; a fourth inner pipe 21 which has a smaller radius by a specific value than the third inner pipe 18, which is arranged inside the third inner pipe 18, which has an upstream side expanding radius portion 75 whose end 74 is secured on an inner surface 81 of the first inner pipe 15, an downstream side expanding radius portion 77 whose end 76 is secured on an inner surface 82 of the finisher 4 and downstream side exhausting holes 17; and the casing main body 3 provided outside the second inner pipe 16.

The downstream side expanding radius portion 77 positioned inside the finisher 4 has, as shown in FIGS. 5A and 5B, the downstream side exhausting holes 17 arranged at specific intervals along a circumferential direction of an outer circumferential surface thereof, the downstream side exhausting holes 17 being formed in an approximately square shape and formed so as to punch out to radial directions so that openings 17a thereof are opened to the third passage 44 side, respectively. Thus, punched out portions become guide portions 17b, so that the exhaust gas can be discharged backward of the finisher 4 efficiently.

According to thus constitution, the silencer mechanism 8 is constituted of the first expansion space 40 defined by the first inner pipe

15, the second inner pipe 16, the downstream side closing bottom surface portion 71 and the upstream side closing bottom surface portion 72 and communicated to the small holes 12; the first passage 41 defined by the first inner pipe 15 and the second inner pipe 16; the second expansion space 43 defined by the second inner pipe 16 and the casing main body 3 and on which the first passage 41 is opened; the second passage 42 defined by the first inner pipe 15 and the third inner pipe 18 and communicating to the second expansion space 43; the third passage 44 defined by the third inner pipe 18 and the fourth inner pipe 21 and communicated between the second passage 42 and the downstream side exhausting holes 17; and the third expansion space 45 defined inside the fourth inner pipe 21, to which the downstream side exhausting holes 17 are opened, communicated to an opening 78 of the finisher 4, and communicated to the exhaust gas introducing pipe 2 by an open condition of the valve mechanism 6.

Thus, when the valve mechanism is in a close condition, the exhaust gas introduced into the exhaust gas introducing pipe 2 is flown from the small holes 12 into the first expansion space 40 formed in the upstream side of the first passage 41, wherein a first expansion is carried out. Then, the exhaust gas is discharged from the first passage 41 to the second expansion space 43 to carry out a second expansion, and further a third expansion is carried out by passing through the second and the third passages 42, 44 and going into the third expansion space 45 from the downstream aide exhausting holes 17 and an outside space. Thus, plural times of expansion can be carried out, so that sound of the exhaust gas is deadened efficiently.

Furthermore, the valve mechanism 6 is constituted of a valve body 51 which opens and closes an end of the exhaust gas introducing pipe 2 and which is in a convex shape such as to project to an upstream side of the exhausting direction A, the spring 52 pressing the valve body 51 to the end of the exhaust gas introducing pipe 2, a mechanism for adjusting pressure 53 for adjusting pressure by the spring 52.

Besides, the mechanism for adjusting pressure 53 is constituted of a holding portion 54 for holding one end of the spring 52 and a rotation portion 55 for adjusting the pressure by moving the holding portion 54 to the valve body 51, wherein the rotation portion 55 is positioned on an extending line of a center line of the muffler 70, so that the rotation portion 55 can be rotated through an opening 78 of the finisher 4 to make it possible to adjust the pressure. Thus, opening valve pressure of the valve can be adjusted.

Concretely, a frame body 57 for fixing a rod 56 on which the rotation portion 55 is screwed is secured inside the exhaust gas introducing pipe 2, and the valve body 51 and the holding portion 54 which is cylindrical with bottom surfaces are fit into the rod 56 slidably. Then, the spring 52 is arranged between the valve body 51 and the holding portion 54 and the holding portion 54 is secured to the rod 56 by a nut as the rotation portion 55.

In thus constitution, when pressure of the exhaust gas applying to the valve body 51 exceeds pressure determined by the spring 52, the valve body 51 is released from the end of the exhaust gas introducing pipe 2 to make the exhaust gas introducing pipe 2 and the finisher short-cut via the third expansion space 45, so that the flowing resistance

of the exhaust gas can be decreased.

Furthermore, the pressure by the spring 52 is increased by moving the holding portion 54 so as to bring near to a valve body 51 by rotating the rotation portion (the nut) 55 and is decreased by moving the holding portion so as to be away from the valve body 51. Thus, the pressure of the spring 52 pressing the valve body 51 can be varied by rotation of the rotation portion (the nut) 55, a desired opening pressure to the valve body 51 can be gained.

A muffler for a motor vehicle 80 according to a fifth working mode is shown in FIG. 6. The muffler 80 is provided with a fifth inner pipe 23 that is arranged outside the second inner pipe 16 and has a closing bottom portion 83 which closes between the second passage 42 and the second expansion space 43 and which connects between the first passage4 41 and the second passage 42, and that defines a fourth passage 46 communicating between the first passage 41 and the second expansion space 43 between the second inner pipe 16 and itself. A junction space 86 to the second passage 42 and the fourth passage 46 is defined on an outlet side end of the first passage 41.

Thus, the muffler 70 according to the fifth working mode is a resonance tube type such that the second expansion space 43 is a resonance space.

Downstream side expanding radius portions 77 as shown in FIGS. 7A and 7B are characterized in that the downstream side exhausting holes 17 arranged at specific intervals along a circumferential direction of the outer circumferential surface thereof are formed in a streamline shape. Accordingly, parts embossed outside in a radial direction are

worked as guide portions 17a each of which is a streamline shape, so that the exhaust gas flown from openings 17c opened against the third passage 44 can be discharged backward of the finisher 4 more efficiently.

A muffler for a motor vehicle 90 according to a sixth working mode as shown in FIG. 8 and FIG. 9 is constituted of the exhaust gas introducing pipe 23 connected to the exhaust side opening of the engine directly or indirectly, the finisher 4 arranged in a downstream side in the exhaust direction on an extending line of the exhaust gas introducing pipe 2, the silencer mechanism 8 provided between the exhaust gas introducing pipe 2 and the finisher 4 and the valve mechanism 6 short-cutting between the exhaust gas introducing pipe 2 and the finisher 4.

The silencer mechanism 8 is constituted of the cylindrical casing main body 3 constituting an outside frame, the first inner pipe 15 which is a cylindrical member with a smaller radius than one of the casing main body 3 and arranged inside the casing main body 3, the second inner pipe 16 which is a cylindrical member with a smaller radius than one of the first inner pipe 15 and arranged inside the first inner pipe 15, and the third inner pipe 18 which is a cylindrical member with a smaller radius than one of the second inner pipe 16 and arranged inside the second inner pipe 16.

The casing main body 3 is that a front end portion 3a thereof is connected with the exhaust gas introducing pipe 2 via a front side cover 10 and a rear end portion 3b thereof is connected with the finisher 4 via a rear side cover 11. The third inner pipe 18 is that a front end portion 18a

thereof is connected with a rear end portion 2a of the exhaust gas introducing pipe 2 and a rear end portion 18b thereof is connected with a front end portion 6a of the valve mechanism 6.

The second inner pipe 16 whose rear end portion 16b is connected with a front end portion 4a of the finisher 4 is secured on the third inner pipe 18 by a calking portion 16c formed on an upstream side portion in the exhaust direction from the rear end portion 16b thereof.

The first inner pipe 15 is secured to the third inner pip 18 by a fixing closing member 91 arranged neighborhood to a front end thereof and secured to the second inner pipe 16 by a calking portion 15c formed neighborhood to a rear end thereof.

A front end portion 16a of the second inner pipe 16 is positioned backward (a little to the finisher 4) from the fixing closing member 91. Besides, the fixing closing member 91 is a wall surface shaped member over a whole circumferential edge of the third inner pipe 18 and closes a space 92 defined between the first and the third inner pipes 15, 18.

The calking portions 15c and 16c are formed plurally at specific intervals along a circumferential direction, so that they do not prevent the exhaust gas from passing through.

Besides, the plural small holes 12 are formed in a part which is a little to the front end 18a of the third pipe 18 from the fixing closing member 91.

The valve mechanism 6 is arranged on the rear end portion 18b of the third inner pipe 18, that is to say, just in front of the finisher 4, and constituted of the fixing member 30, the rod member 31, the valve body 32, the valve sheet 33, the spring 34, the spring shoe 35, and a means for

adjusting pressure 36.

The fixing member 30 is secured on the rear end portion 18b of the third inner pipe 18 and has a shape such that the exhaust gas can pass through. A front end of the rod member 31 is secured on the fixing member 30. The spring shoe 35 is secure on a rear end of the rod member 31. The valve body 32 is an approximately conical shaped member and is fixed slidably along an axial direction of the rod member 31. The valve sheet 33 is provided on the rear end portion of the fixing member 30 and has a shape such that the valve body 32 can be in contact with it. The spring 34 is that a front end thereof is fixed on an inner surface portion of the valve body 32 and an rear end thereof is fixed on the spring shoe 35. The means for adjusting pressure 36 is such that the pressure of the spring 34 is adjusted by moving a fixing position of the spring shoe 35 slidably along the rod member 31 and has a constitution such as to be rotated by a hexagonal wrench and so on.

According to the muffler 90 with the above constitution, when pressure of the exhaust gas from the engine is smaller than pressure of the spring 34 (and atmospheric pressure) (a usual traveling), as shown in FIG. 8, the valve body 32 is in a closing condition, so that the exhaust gas flown out of the exhaust gas introducing pipe 2, as shown by an arrow A, enters into a first space S1 defined inside the third inner pipe 18, entering a second space S2 defined by the third inner pipe 18, the first inner pipe 15, the fixing closing member 91 and the front side cover 10 via the small holes 12, passing through a third space S3 defined between the casing main body 3 and the first inner pipe 15, passing through a fourth space S4 defined by the first inner pipe 15 and the second inner pipe 16,

passing through a fifth space S5 defined between the second inner pipe 16 and the third inner pipe 18, then discharging to the outside via the finisher 4. Thus, in an exhaust gas route at the usual traveling, the exhaust gas passes through a complicated pulsation decreasing passage constituted of the spaces S1, S2, S3, S4 and S5, so that the pulsation can be decreased sufficiently.

Besides, the second space S2 and the third space S3 constitute the first expansion space, the fourth space S4 and the fifth space S5 constitute the first passage, and the space inside the finisher 4 constitutes the second expansion space.

On the other hand, when the pressure of the exhaust gas from the engine is larger than the pressure of the spring 34 (and atmospheric pressure) (a high-power traveling), as shown in FIG. 9, the valve body 32 moves to an opening condition, so that the exhaust gas goes from the first space S1 to the finisher 4 directly as shown by an arrow A'. Thus, the resistance of exhausting is decreased, so that the output of the engine is increased.

Furthermore, the valve mechanism 6 is provided on the downstream side end portion of the third inner pipe 18 that is just in front of the finisher 4, so that the exhaust gas flown out of the exhaust gas introducing pipe 2 rushes into the first space S1 in spite of the opening or closing condition of the valve mechanism 6 and then discharges to the second space S2 via the small holes 12, so that the first space S1 can be employed as a resonance space. Thus, performance of sound deadening can be increased.

INDUSTRIAL APPLICABILITY

As the above, according to the present invention, because the inner pipes are provided inside the casing main body in turn and spaces defined between them are employed as a flow passage of the exhaust gas, miniaturization of the muffler can be achieved as the performance thereof is maintained.

Besides, when the pressure of the exhaust gas from the engine becomes more than a specific value, the valve mechanism is in the open condition for the exhaust gas to flow into the finisher directly. Thus, the resistance of exhausting is decreased, so that the muffler characteristics corresponding to the traveling condition can be gained and the output of the engine can be increased.

Furthermore, in the case that the valve mechanism is provided just in front of the finisher, the exhaust gas flown out of the exhaust gas introducing pipe rushes into an upstream side space of the valve in the closing condition of the valve mechanism and flows into the first expansion space via the small holes, so that the upstream side space is employed as a resonance space to constitute a resonance tube type of a silencer mechanism, as a result, the sound deadening performance can be increased.

Moreover, the valve mechanism is provided in a position facing to the opening of the finisher which is an end portion of the exhaust gas introducing pipe, so that pressure for opening valve can be adjusted easily from the opening of the finisher.